

A Routing algorithm for non-uniform mesh network on NoC

¹Utkarsha D. Zod, ²Prof. Amol Boke
Electronics and Communication Department,
G. H. Rasoni Academy of Engineering, Nagpur, India

Abstract: NoC allows integrating large number of IP cores into a single chip. It provides scalable communication structure where different cores are connected in some particular fashion. Due to irregularity in size of cores, routing problems are established hence the regular topology fails maintaining the interconnection and need of algorithm for irregular topology arisen. In the existing work Van Neumann architecture is used in the development of NoC router based non uniform structures but this falls due to less efficiency for high speed applications. In this proposed paper an algorithm uses concept of cellular automata which is helpful parameter regarding to improve latency as well as throughput by retaining information of its four neighbours. The method is followed by degree priority algorithm for optimal path based on the degree, using partial reference scheme the method becomes effective. By introducing this concept method become pivotal in role in irregular mesh topology which proves compatibility. Therefore the best path from source node to destination node is chosen.

Index term: Cellular automata, NoC, degree priority, irregular mesh topology.

Introduction

Network on chip (NoC) is the one which provides reliable on chip communication architecture. A single NoC system should be compatible to different size, functions and communication requirements. NoC architecture provides scalable communication infrastructure where different cores are interconnected. Network topology refers to the shape of on chip networks and influences router design and the way the nodes are connected and communicate by network topology. It consists of basic building block as given below:

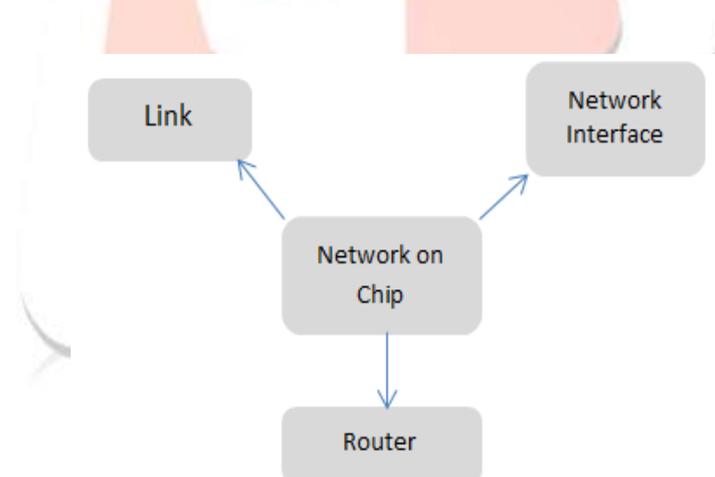


Fig1:- Basic Building Block

Links: It physically connects nodes according to chosen topology and implements the communication.

Router: It receives packets from shared links and according to the address informed in each packet, it forwards the packet to the core attached to it or to another shared link.

Network Interface: The block makes logic connection between IP core and the network.

The links ultimately gives performance in NoC and designers are supposed to provide fast reliable and low power interconnects between nodes in the network. The physical layout and communication between nodes in the network is determined by the on chip network topology. The mesh topology is one of the relevant topology uses in the networks. The main advantage of this topology is that the network traffic can be redirected to other nodes if one of the nodes goes down and the data can be transmitted from different devices simultaneously. If one node can no longer operate others can still communicate with each other directly or through one or more intermediate nodes so data transfer doesn't get affected.

Topology uses to relay messages using routing technique either. Routing algorithm is the logic that selects one output port to forward a packet that arrives at router input. The XY routing is used to have an optimal path, when source horizontal value is more than destination value then message is route to East direction and to the West in vice versa. If message is aligned at the horizontal position then it directly route to vertical direction. In vertical direction case if the source's vertical value is more than message is route to South direction and to the north in vice versa. It is an efficient method to obtain shortest path. The degree priority is based on degree of next node is an improvement over XY algorithm for irregular mesh topology followed by optimal path. Here we will be using Von Neumann's cellular automata where the cells are arranged in two dimensional Cartesian grid and interface with the surrounding four cells. It can be also known by the name Van Neumann neighbourhood. The degree of the four neighbourhood of central node can be known by this method and accordingly based on the highest degree with respect to the method of partial reference, optimal path is chosen to route a message.

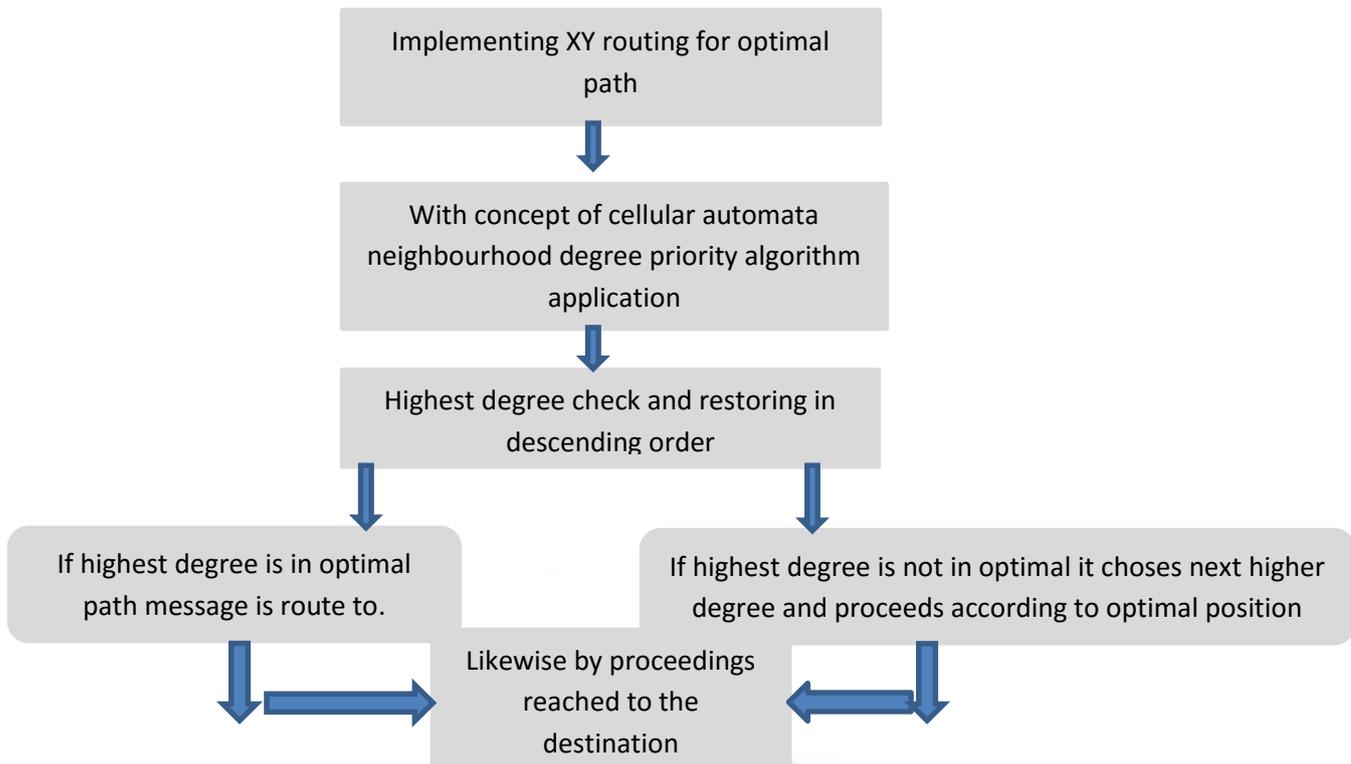
Literature Review

inming Duan, Yuanyaun Li [1] has introduced hybrid scheme multiphase routing algorithm for irregular mesh integrating oversized rectangle modules. The idea is taken from fault tolerant where mesh becomes irregular due to fault regions. The proposed scheme uses two virtual channels per physical channel with fast routing decisions. In these two phases XY routing algorithm is used messages round oversized components through two phases. Each message is initially the first phase message. The first phase message will not become second phase until offsets between current node and intermediate node equal to zero. Two phase XY routing algorithm is deadlock free, it may not keep connection if number of regions integrated oversized IP modules increases now according to **Ling Wang Huisang Dongxin Ven[2]**, the degree priority algorithm is best suited among all rest routing such as SR routing , DR routing , XY routing for irregular mesh NoC architecture. In degree priority routing algorithm, the routing path is dynamically selected with respective to the communication status of the next hop node. Deadlock is not considered in this paper, after the routing path is decided virtual channel is applied to avoid deadlock problem. **Parisa Mahdavinia[3]**, proposed to overcome the problem of irregular size and shape of module , concept of region is introduced. This concept allows a rectangular area, larger than tile in the mesh to be declared as a region. Indeed a region acts as an obstacle to the network to the network traffic. Routing is divided in two directions, first from East to West and second from West to East. WE routing follows the static XY routing which consist of phase 1 an d phase 2. In phase 1, the offset along the x-dimension is reduced to zero and in phase 2, the offset along the y dimension is reduced to zero. WE routing chooses dynamic XY routing algorithm is adaptive and work based on congestion condition. It was shown the proposed routing algorithm has superior performance in terms of message latency and power consumption.

Methodology

We propose a method for designing of routing algorithm so that situation of deadlock is negligible. The very important factor which is always been a demand in networking to be efficient is latency considered to be improved. We are using cellular automata based degree priority algorithm to improve latency of the system. The technique is used for non-uniform network which is a todays need to work upon for trusted communication is taken due to irregular size of modules. The basic XY routing algorithm is taken into consideration which is one of the best methods in regular mesh topology for choosing an optimal path. In the XY routing algorithm, the source node and destination node is compared and according to it the message is routed in the x direction first and then in y direction depending on the destination node position. The degree priority algorithm is followed to get best routed path to the destination which is based on the degree of node where it is seen that number of output path is available at the node is maximum and which is available at the optimal path. The degree priority is merged with cellular automata neighbourhood concept which will be helpful to increase latency. Cellular automata neighbourhood concept is brought up with the retaining degree information of four neighbourhood node to decide the best path to route to. This way the time is saved. The flow of the method is given as below:

FLOW CHART



References

- [1] Xinming Duan, Yuanyuan Li, "A multiphase routing schemes in irregular mesh based NoC's", IEEE 2011.
- [2] Ling Wang Hui Song Dongxin Wen, "A degree priority routing algorithm for irregular mesh topology NoC's", IEEE 2008 International Conference on Embedded Software and Systems (ICES2008).
- [3] Parisa Mahdavinia, Hamid Sarbazi-Azad, "An efficient routing algorithm for irregular mesh NoC's" IEEE 2010.
- [4] Dakun Zhang, Xuemei Sun, Xinming Duan, "Routing schemes of an irregular mesh based NoC", 2009 International conference on Network security, wireless and trusted computing.
- [5] Ankur Agarwal, Florida Atlantic university "Survey of Network on chip Architecture and contributions", Journal of Engineering, computing and Architectures ISSN 1934-7197 Volume 3, Issue 1, 2009.
- [6] Mehdi Mohtashamzadeh, "A new routing algorithm for irregular Mesh NoC's without virtual channel" 5th European symposium computer modeling and simulation 2011.
- [7] "Evaluation of routing for Mesh topology Network on Chip Platforms" by Saad Mubeen, Master science Thesis 2009 Electronics, TEKNISKA HOGSKOLAN.
- [8] Qingli Xiao, "An efficient routing scheme for irregular mesh NoC's", IEEE 978-1-4673-4933.2004.
- [9] Network on chip Routing algorithm by Ville Ratnala, Teijo Lehtonen and Juha Plosila, Turku Center of Computer science No. 779, August 2006.
- [10] Shubhangi Chawde, Mahendra Gaikwad, "Review of routing algorithm for NoC Architecture", IEEE 978-1-4673-4933.2004.
- [11] Ms. A.S. Kale and Prof. M. A. Gaikwad "Design and analysis of on chip router for network on chip" IJETAE ISSN 2250-2459, volume 2, January 2012.
- [12] Shashi Kumar, Axel Janlsh, "A network on chip Architecture and design Methodology", proceedings of IEEE computer society Annual symposium on VLSI 2002.
- [13] Nature of Code by Daniel Shiffman.