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Von Neumann Neighbourhood based Routing Algorithm for Non regular Mesh Topology NoC's

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ABSTRACT: Variation in sizes of modules leads to finding of methods which can provide communication with minimum cost possible integrated on chip. The routing algorithm which are used for regular mesh and which are very efficient like XY routing algorithm fails when it comes for irregular structure NoC. Routing algorithm is the logic that selects output port to forward packet that arrives at router input. There are numerous Routing algorithm, we are using degree priority algorithm which enables fast and dynamic routing. By introducing the Cellular Automata based neighborhood into the picture, the proposed techniques will enables each node to retain the degree information of its 4 neighbors and serves as a hub. In this paper, degree of four neighborhoods is known by Cellular Automata neighborhood method which then takes decision to route to the next hop depending on the state of its four neighbors, In this method it finds the path with minimum hops as possible which influence the cost of hardware minimally**.**

KEYWORDS: Network on Chip, Cellular automata neighborhood, degree priority

I. INTRODUCTION

Network on chip allows integrating large number of IP cores into a single chip. For Interconnection in system on chip(SoC) Network on Chip is the promising over the conventional bus based SoC. It provides scalable communication structure where different cores are connected in some particular fashion. 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. Its architecture provides 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.

Topologies specify architecture of Network on chip and arrangement of Modules and their interconnection relationship. NoC can be characterized by the structure of the routers connection. This structure organization is called topology. Mesh topology is one of the convenient method for communication but due to raised problem of sizes n shapes that turns to irregular topology. Irregular topology in terms can be defined where IP modules are connected to a node which is connected to four nodes in four direction and due to size regular structure of connecting nodes changes to irregular pattern. As XY or YX routing do not proven efficient which provides shortest path to the destination but when it comes to irregular structure then there need arise for irregular mesh where connectivity and hardware cost remains efficient. The aim of power and area for NoC is one of the basic requirement which should be accomplish. The concept of irregular mesh topology is brought from [1]. Several routing techniques in irregular mesh denotes problem and hence need to develop routing algorithm which can be compatible in the environment of irregular mesh structure. The main constrains are at cost of power consumption and area.

A degree priority algorithm[1] is one of those efficient method used for irregular mesh in which degree of four neighborhood node is known and on the basis of highest degree node and optimal path decision is taken. Routing tables are maintained in the either router which then combine where common values appears. This method becomes efficient because it entraps the region where missing link would be get. The method to find degree is shown below in the figure:

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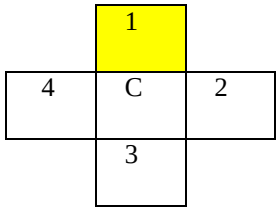

Fig. 1

As per figure the node 1 is missing then the path will be available through node 2,3 and 4 so the degree will be 3 as three nodes are available likewise those number of nodes are available that will be the degree of its central node .
Cellular Automata Neighborhood: In the cellular automata evolution, the value of center cell is depending on the value of its four shaded neighbors. These rules mainly involve the state of the automaton's neighbors. At each time step, when automata reads symbol it jumps to another state. Depending on the final state automata, automata either accept or reject input state. It can communicate four neighbors at a time. So this concept brings the information at the same from its four neighborhoods and retains it to the central node. The decision for central cell is depend on the values of its four neighborhoods. Thus, information of four neighbors is retain by central cell. Each node is bound model and repeats its process. so relative map can easily calculated all four nodes in the network for every time . If there is active neighbor, the current node saves reply. Nodes saves the location information and passes it on to other neighbor nodes.1-North , 2 - East , 3 - south, 4 - west. Since a network retaining always information of 4 neighbors , computational capacity alaways remain 4.

This neighborhood can be more complex, with increase in the number of adjacent neighbors. The one most common method is Von Neumann Neighborhood. This neighborhood can also be termed as 'five neighbor square' which can be represented as shown in the figure.

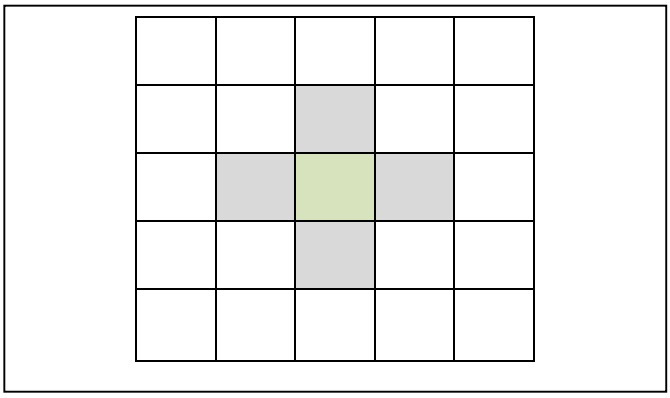

Fig.2

II. RELATED WORK

In this paper, a degree priority (DP) routing algorithm is extensively used for finding degree of its four neighbor which includes the concept of cellular automata neighborhood. With the information of four neighbors the performance of the network id improved. In this algorithm the next hop is selected on the basis of highest degree which is available on the optimal path will be preferred first. After selecting the next node again go for the same process. Optimal path: The path belongs XY or YX route where the distance to the destination node considers to shortest.

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III. PROPOSED ALGORITHM

The network is deployed. Source node is selected which will look for the next node by applying degree priority given in [1]. While selecting the degree rules for CA neighborhood is applied which will give the information of its four neighbors at the same time? If highest degree is not available for optimal path it will go next highest degree which falls on optimal path. If the no node is on optimal path then it will go for highest degree for remaining path. The path is randomly selected when degree is same for node which falls on optimal path or if other than optimal path node needed to select. Once the next node is selected the next node will go through the same decision pattern. The example described below will clear the idea for reaching to the destination

		3					
	4	X	4 a	4 b	3		
		3		4 c	4 d		
				3	4 e	4 f	
						Y	

Fig.3

1. In the figure above X is taken as a source node and Y is taken as destination node. It will start from node X. 3 holes are taken.
2. Checking for the highest degree which will available on optimal path. As degree 4 is available at node ‘a’ it will select node as shown in the figure.
3. Node ‘a’ will check highest degree as node ‘b’ having degree 4 it select node ‘b’.
4. Node ‘b’ will check highest degree as node ‘c’ having degree 4 and on optimal path it select node ‘b’.
5. Node ‘c’ will check highest degree as node ‘d’ having degree 4 and on optimal path it select node ‘d’.
6. Node ‘d’ will check highest degree as node ‘e’ having degree 4 and on optimal path it select node ‘e’.
7. Node ‘e’ will check highest degree as node ‘f’ having degree 4 and on optimal path it select node ‘f’.
8. Reached to node Y.

IV. RESULT ANALYSIS

Irregular mesh is created due to Irregular size of modules. Routing tables are maintained at every hop which contains the whole network connectivity. In our proposed method we are taking entries in the routing table only of four neighbors due to which cost is reduced in terms of area as well as latency improved as only four neighbor information is retrieve by central node. Hence throughput increases. The observation is taken with the help of NS2. Communication probability of hotspots: communication probability between node and hotspot[1]. With the same number of hotspots, the network with higher communication probability of hotspots has higher communication load. Communication probability of non hotspots: Communication probability between node and non-hotspot. The probability to communicate to a non hotspot node is kept low at 0.1.Here we have shown among 64 nodes communication probability 0.1, 0.3 and 0.5 for the network size of 8*8 mesh. Figure denotes different routing cost obtained by proposed algorithm. The node values are stored in the form of bits for every node selection to find path for the destination. The

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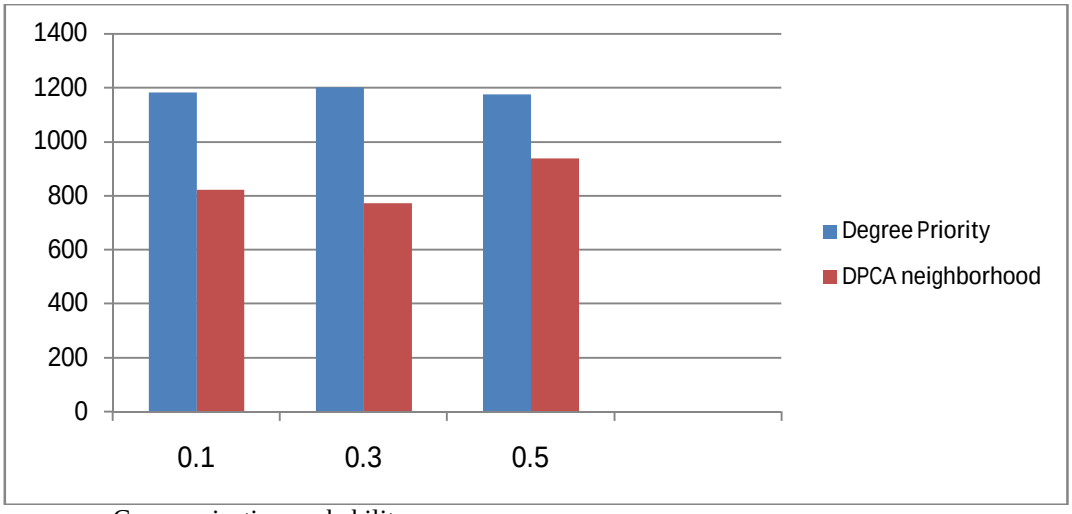
bit value is calculated by the formula [1] which in terms calculate as a cost. For the communication probability 0.1, 0.3 and 0.5 degree priority cost is given 1182, 1200 and 1176 bit which is efficient than many routing algorithm such as SP routing, DR routing etc. By a proposed routing the value is more efficient in terms bits when compared to the Degree priority routing. The cost for DP CA neighborhood is 821, 773 and 939 respectively.



Communication probability

V. CONCLUSION

Different sizes of modules integrated on a chip cannot maintain the regularity of the network. So there is need of algorithm which can work in the environment of irregular mesh is in demand. In the non regular mesh value by degree priority algorithm by the concept of cellular automata brings the efficient values than the degree priority in terms of reduced number of bits which in turns facilitates the cost efficiently. Further partial reference method maintains the connection to the destination where maximum delay can be avoided. Experimental results show that the method used is advantageous in respect of performance over the degree priority algorithm.

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