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Proposed algorithms of routing in new class of Modified Alpha Network

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Abstract: ***Routing is a technique to transfer information between source and destination in a network. Routing is of two types i.e. static routing and dynamic routing.Routing in a dynamic INs involves choosing alternative paths in place of faulty paths. In a multicomputer network routing can be done through centralized or distributed control. In this paper Fault Tolerance of the proposed MIN Modified Alpha Network (MALN) has been evaluated.. All the path lengths available from source to destination have been analysed. The algorithms have been proposed to counter the faults in MALN.***

Index Terms **Algorithms of routing, Fault Tolerance, path lengths in MIN, Redundancy Graph, Types of routing.**

I. INTRODUCTION

In centralized routing [2] , a particular node makes the routing decisions on the basis of status of all the nodes in the network Sengupta J (2005). The main disadvantage of this scheme is that a powerful central node is required to handle all rooting requests from all nodes and resists to failuers. On the other hand , in distributing routing the decisions are shared among all nodes. Data moves from node to node and routing decisions are made by intermediate nodes. This type of routing can be Fault-Tolerant as there is no central node.

Ways to perform Routing

a) Path setup
In a static network the path between two communication nodes is setup before execution of task and remains same for the duration of the program. The communication requirements of a program are known in advance. But if the requirements of a program are not known, then dynamic path selection [3] is used.
Circuit switching and packet switching are the two methods which are used in dynamic path selection.

b) Path selection

As there are many paths between source and destination in a network, two approaches named deterministic and adaptive are used to select a path.
In adaptive routing, routes are chosen independently for each communication. In deterministic approach i.e. static routing, the path is determined by the source and destination address.

c) Network flow control

In circuit switching approach , communication path is set before the data transfer begins. But in packet switching data transfer begins before a complete path is setup, this situation leads to packet block [4] if path is busy.The network flow control Chalasani S et al. (1994) method avoids network queue overflow and underflow, which in turn regulates the movement of data in network.

II. FAULT TOLERANCE OF MALN MIN

The proposed MALN satisfies the Fault-Tolerant criteria Jeng M et al. (1986), as it can work in the presence of certain faults. If there is fault in the primary path, then secondary path will be chosen for routing the data. Moreover the auxiliary links in all the stages except the last one provides the alternate route [1] of the data. The critical case (cr) is when the fault is present in the SE in same loop. In this case, certain pair of source and destination shall be disconnected. In Fig 1, thick lines show all the paths, along with alternate paths, from source 0000 to destination 1010. Two disjoint paths in the two groups provide Fault-Tolerance in MALN.

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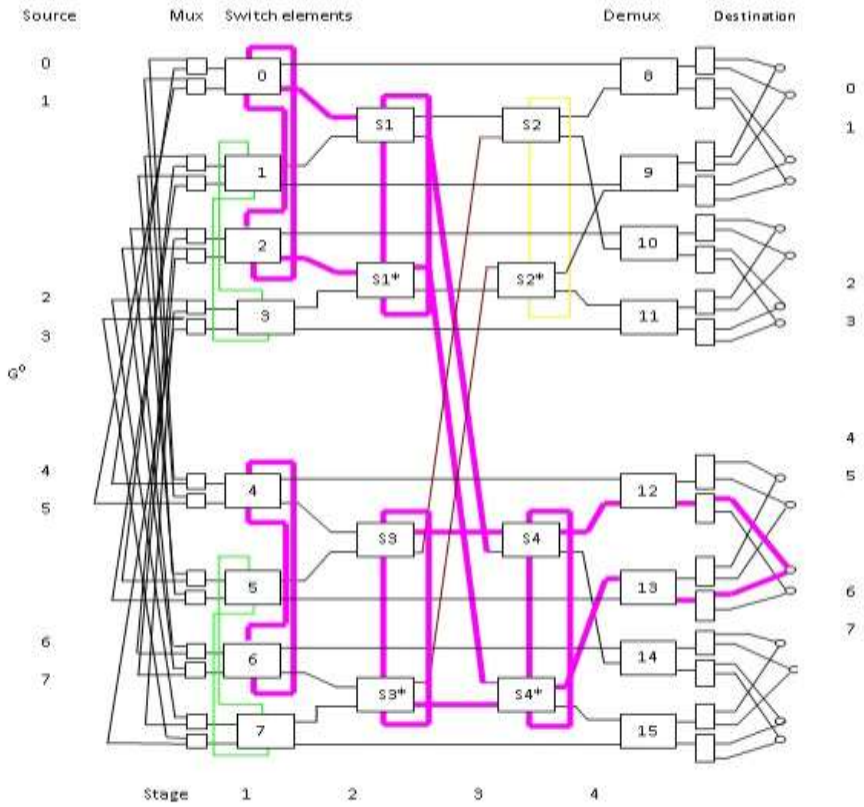

Fig 1: Multiple paths from source 0000 to 1010 in MALN of size 16*16

III. REDUNDANCY GRAPH

It is a graph [1] that shows all the paths available in the network. Fig 2 shows the redundancy graph of the MALN.

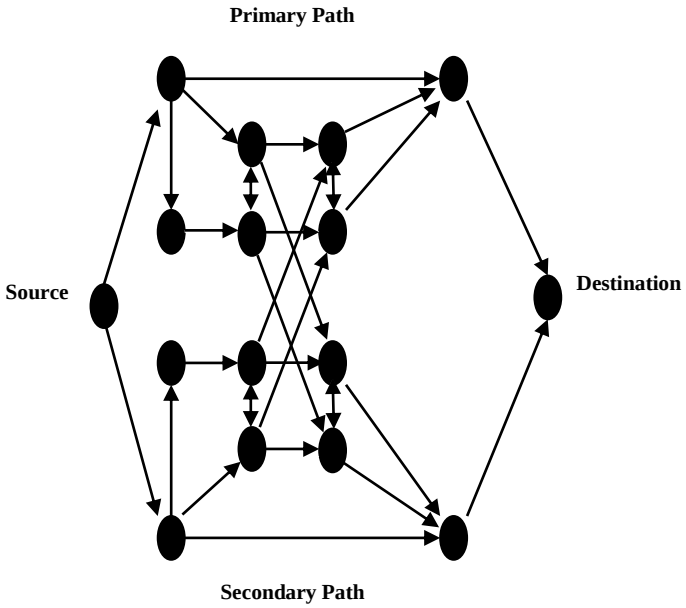

Fig 2: Redundancy Graph of MALN

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IV. ALGORITHM OF ROUTING OF THE PROPOSED MIN

Let the source and destination in binary be represented as

$$S=S_{n-1}\ldots\ldots\ldots\ldots S_1S_0$$

$$D=D_{n-1}\ldots\ldots\ldots D_1D_0$$

Step 1: Start

Step 2: The MSB of the destination address [2] is checked and on the basis of it, one of the sub networks G^0 or G^1 is selected.

Step 3: Let us suppose the address of the following SE is known. If the destination address is the address of this SE, then the shortest path is used and the further routing is not required as the data has reached the destination.

Step 4: If the SE is busy then route the data to auxiliary SE through auxiliary links. If this is also busy then drop the request. Otherwise go to step 5.

Step 5: The secondary path [3] is selected .Set MSB of the routing tag as 1.The bits of the destination will make the data to reach the destination through intermediate stages. If the SE in any of the stages except the last one , is busy, go to step 5.

Step 6: Route the data to auxiliary switch in the same stage (Route the data to Auxiliary switch in the previous stage in case of faulty SE).

Step 7: Bit D_0 of the routing tag will guide the data through a particular demultiplexer and the destination will be reached.

Step 8: Stop

Sample: Routing example from source 0000 to all destinations for the MALN has been listed in Table1

Table 1: All Path Lengths available in MALN

Source	Destination	Path Lengths Available
0000	0000	2,4
	0001	2,4
	0010	2,4
	0011	2,4
	0100	4
	0101	4
	0110	4
	0111	4
	1000	2,4
	1001	2,4
	1010	2,4
	1011	2,4
	1100	4
	1101	4
	1110	4
	1111	4

The function of the path lengths available in MALN is $\log_2(N)$-2, $\log_2(N)$.

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Theorem 1: Modified Alpha Network is single switch Fault-Tolerant in all the stages

Proof: The auxiliary links [4] are available in all the SEs in all the stages except the last one. If fault in any of these SE happens, then the data will be routed to the auxiliary SE in the same stage through auxiliary links.

Theorem 2: Modified Alpha Network will be able to work in the presence of faults in the SEs in the loop in one Group at a time.

Proof: By guiding the data from the other Group (Fault-free) to the same stage, where the fault was present in the faulty Group [3] , the request can be passed to the desired destination.

Lemma 1 : If all the SEs in the loops in both the groups are faulty then Modified Alpha network fails.

Repair: To rectify, just replace the loop engaged in the faulty components.

V. CONCLUSION

The routing tag and routing scheme of MALN network have been described. It has been observed that the proposed MIN is Fault Tolerant and has average latency of 3.0 clock pulses as compared to 3.5 of its comparative MINs. The proposed MIN also has less number of stages.

It has more number of requests getting matured, at 100% request generation rate, in the case of critical and non-critical faults in the SEs in the intermediate stages, as compared to same class of existing networks.

The proposed Network is Fault-Tolerant in the presence of multiple faults in the network. Moreover auxiliary links present makes the network more reliable.

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