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Evaluation of Path Lengths in Proposed Triangle Network

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Abstract: Routing tag provides the algorithm to pass the data from source to destination in a network. In this paper Fault Tolerance of the proposed MIN Triangle has been analysed . All the path lengths available from source to destination have been found.

Keywords: *Fault Tolerance, routing tag redundancy graph, fault tolerance and repair, algorithms of routing.*

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I. INTRODUCTION

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. The routing can be performed by observing the path setup, path selection and network flow control.

ARCHITECTURE PROCEDURE OF TRIANGLE NETWORK

The network is an Irregular MIN of size N*N. It has N sources and N destinations. The Triangle network of size 2^n*2^n consists of (2m-2) stages. This network has (2^n -2) no. of switches of size 3*3 and 2^{n-1} no. of switches of size 2*2.Each source is connected to one SE in each group with the help of N multiplexers and is connected to the output with equal number of demultiplexers.

The network comprises of two identical groups of SEs, named as G^0 and G^1. The network of size 16*16, with labeled switches is shown in Fig1.

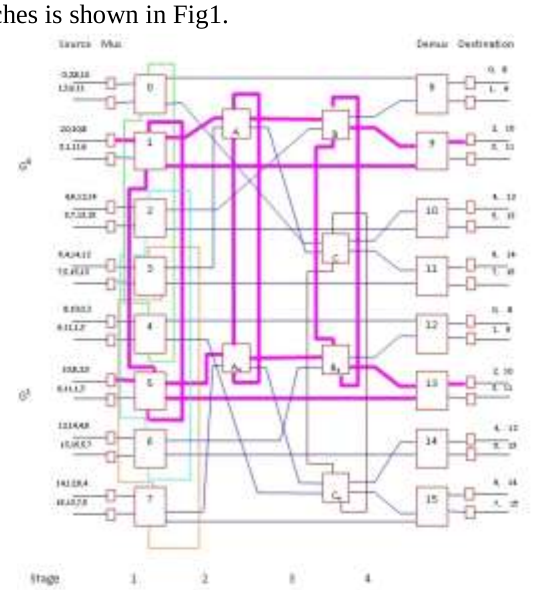

Fig 1: All paths available from source 0000 to 1010 destination in Triangle MIN

II. REDUNDANCY GRAPH

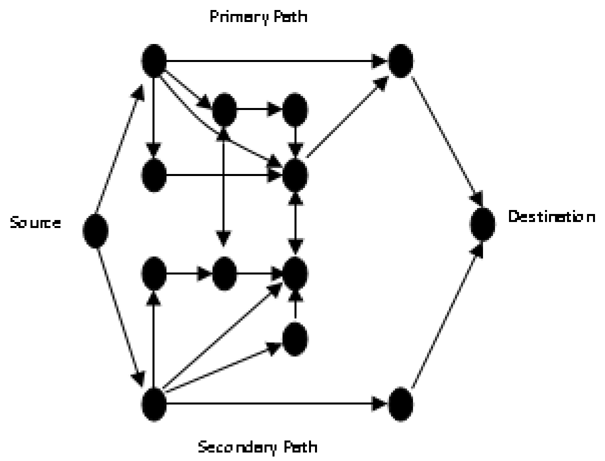

Fig 2: Redundancy graph of Triangle MIN

Routing method and analysis of proposed MIN in the presence of faults

Let the source and destination in binary be represented as

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

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

Let the routing tag Koppelman D. M et al. (1990) be denoted as $t_m t_{n-1}\ t_{n-2}\ldots\ldots t_0 t_{dm}$, where

t_m is the multiplexer control bit.

t_{n-1} is the bit being sensed by SEs of the first stage.

t_{n-2} is the bit being sensed by SEs of the second stage.

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t_0 is the bit being sensed by SEs of the last stage.

t_{dm} is the demultiplexer control bit.

The function for routing tag and routing procedure is

$t_i = d_i$ for all ($0\leq i \leq$ n-1) where n= $\log_2 N$

$t_i = [\ (S_{n-1} \oplus d_{n-1}) + (S_{n-2} \oplus d_{n-2}) + \ldots\ldots\ldots + S_{n-i} \oplus d_{n-i}\ )]$ for all $n\leq i \leq n$, where $\oplus$ is exclusive or'

$t_m = s_{n-1}$

$t_{dm} = d_{n-1}$

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Routing example from source 0000 to all destinations for the Triangle Network has been listed in Table 1.

Table 1 : All Path Lengths available in Triangle Network

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 Triangle MIN is $\log_2(N)-2$, $\log_2(N)$.
The path length for favorite memory module is $\log_2(N)-2$.

III. FAULT-TOLERANCE AND REPAIR

The proposed MIN satisfies the Fault-Tolerant criteria because 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, there are multiple paths from one type of source to one type of destination which makes this network more Fault-Tolerant and reliable Kamiura N et al. (2000) The auxiliary links in all the stages except the last one provides the alternate route of the data. The critical case is when the fault is present in the SE in same loop. In this case certain pair of source and destination shall be disconnected.

Theorem: Different path lengths are available for routing from source to destination in primary and secondary routes.

Proof: The probability of request forwarding within stages of the Triangle Network is different. Moreover, the auxiliary links 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.

Lemma : Triangle Network maintains the connectivity in the presence of the fault, only if the auxiliary SE in the same stage is Fault-free.

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

Fig 1 shows the multiple paths available from source 0000 to destination 1010.

The routing tags used to transfer the data from source 0000 to destination 1010 in the respective faults of stage 3, where the secondary path is established by complimenting the MSB of the routing tag.

IV. CONCLUSION

A new class of Fault-Tolerant Irregular Dynamic MIN named as Triangle Network has been proposed in this paper.The algorithm of routing tag and routing scheme of this proposed network have been evaluated. It has been observed that the proposed MIN is fault tolerant in the presence of faults. For 100% requests generation, Triangle MIN passes 50% more requests as compared to comparative MINs. When the critical faults are present in the stage 3 the proposed Triangle MIN, passes 37% of the requests generated.

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