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6. AUTHOR(S)
Suresh Rai

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Electrical and Computer Engineering Department
Louisiana State University
Baton Rouge, LA 70803-5901

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Over the one-month grant period new techniques in the problem of evlauating the reliability of fault-tolerent network were proposed. Theorems were proved and examples fully worked out ot demonstrate the viability of these methods.

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Suresh Rai; Louisiana State University, Baton Rouge

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INTRODUCTION

The loop or ring network is commonly used for the interconnection of computers that are in close proximity, such as those in local area networks (LANs) and metropolitan area networks (MANs). An ANSI/IEEE Std. 802.5 draft provides some standards on the topic. Besides, the fiber distributed data interface (FDDI) is an ANSI computer network interconnect technology for a high spped (100 Mb/s) token ring using an optical fiber medium. The FDDI has both packet and circuit switching capability, and thus has the potential to integrate diverse service needs of real-time voice, video and data streams.

Note, a simple loop where all the links are configured to carry messages in one direction only eliminates any routing overhead. However, it poses a serious reliability problem. A single link failure disconnects the loop and, thus, makes the loop highly vulnerable to single-point failures. Several bidirectional, double loop structures have been proposed that overcome the inherent fault-tolerance problem. Some typical architectures include braided-loop, daisy chain, FLBH, etc., [1]. Out of various double loop topologies studied in the literature, some schemes have been tried experimentally. Recently, it has been reported that NASA Langley Research Center has implemented a daisy-chain architecture as a candidate for interprocess communication on the space station. Considering the criticality of the application it is imperative to focus the attention on tools and techniques of reliability/availability modeling of the fault-tolerant double-loop interconnection schemes.

Several reliability measures are proposed in the literature. To ensure correct performance of a distributed system the basic strategy (with all these methods) lies in maintaining some kind of connectivity of the network. [That is, each processor (node) must be able to exchange information with an other processor.] The probability of connectedness, then, refers to an appropriate reliability measure. For example, the

availability of source-sink paths (spanning trees) defines terminal (global or network) reliability. Various methods, namely inclusion-exclusion, factoring, sum of disjoint-products etc., are used to solve the reliability problem in a general network. An attempt to use these techniques directly to find reliability in double loop topologies fails to exploit the considerable symmetry for the given situation and will be much more expensive in terms of memory and number of arithmetic operations.

We proposed the following topics of research: (a) To develop a 'generic' model to analyze reliability measures in different braided line networks. (b) To solve reliability problem in double-loop structures viz. DDLCN, daisy chain and FLBH [2]. For (a) and (b), we planned to look into both measures namely terminal and network (or global) reliabilities under node and link failures assumption.

RESULTS

To help solve reliability measures in the braided architectures techniques are proposed in [1]. Note, a braided line graph provides a basic building block for daisy chain or ring communication networks. A recursive method proposed in [1] computes exact terminal and network reliability measures. Various theorems are stated and proved in the text. We have included experimental results and examples to illustrate the method. It is not shown in the report but the author has successfully applied the technique for 3 and 4 jump choices too.

Reference [2] provides an overview of 2-input 2-output directed graphs which are suitable for FDDI, LANs, and MANs.These networks are classified as 1-, 2-, or m-dimentional graphs based on the number of tuples used in their node addresses. These networks are compared based on the diameter, average path length, connectivity, and routing.

To generalize the results of [1] for double-loop structures viz. DDLCN, daisy chain and FLBH we faced some problems in terms of time. We are still working on this issue and have plans to involve graduate students too.

REFERENCES

[1] Suresh Rai, "Recursive technique for reliability computation in braided-line networks," Technical Report, #90-08-100, August 1990.

[2] Suresh Rai, "Doubly connected directed graphs for local communication system interconnection," Technical Report #90-07-110, July 1990.