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Reduce the Cross Talk in Omega Network by Using Windowing Techniques

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Abstract:-When we work on a distributed network with n number of systems attached with m number of resources. In such case there are number of approaches to connect the system and the resources. One of such approach is Multistage networks. Where some middle level interface systems or the switches are attached between the systems and the resources. But such kind of networks having the problem of confliction when more than one transmission is taken place at one time. In such case there is the possibility that any one line can share more than one transmissions. As the conflictions occur there are much chances of data loss over the network. We are providing the solution for the above defined problem in case of Omega Networks. In this paper we proposed solution the system will first detect the confliction using windowing method. Once the confliction detected the next step is to vary the time of transmission between these two transmissions. As the communication is performed at different time lines it will resolve the problem of confliction in omega networks.

Keywords:-*Omega networks, window techniques*

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1. INTRODUCTION

An optical computer network is a network that relies primarily on the computing power and bandwidth of the participants in the network rather than concentrating it in a relatively low number of servers.

Such networks are useful for many purposes. Sharing content files (see file sharing) containing audio, video, data or anything in digital format is very common, and real time data, such as telephony traffic, is also passed using Optical technology.

Due to the limited capability of single stage networks, multistage interconnection networks (MINs) were developed as a method to improve on the limitations while at the same time keeping costs low. A MIN consists of several cascaded single stage networks (a set of 2 x 2 switching elements) connected by an Inter-stage Connection Pattern. The switches used perform their own routing based on the destination address (self-routing). For N x N MINs, there are $\log_2 N$ stages and that is also the number of bits in the destination address. [1] For routing, each bit of the destination is used for one stage, and the address is read from left to right. The standard for a MIN is that a 0 as the control signal means the communication should be routed through the upper output of the switch whereas with a 1, the signal is routed through the lower output. With most INs, the values for the control signals come from the destination address.[2]

A multistage network connects a number of processors to a number of memory banks, via a number of switches organized in layers, viz:

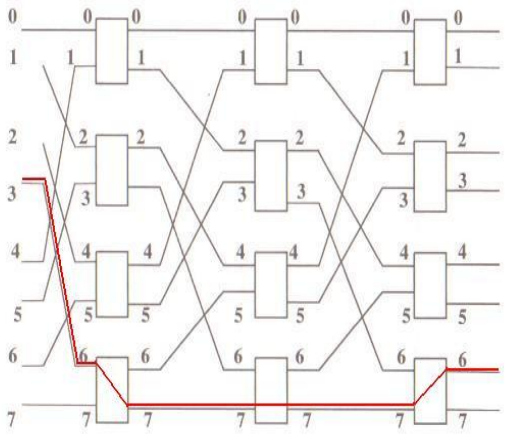

Fig. 1.Multistage Networks

2. NEED TO REDUCTION OF CROSS TALK

Crosstalk in optical networks is one of the major shortcomings in optical switching networks[11], and avoiding crosstalk is an important for making optical communication properly. To avoid a crosstalk, many approaches have been used such as time domain and space domain approaches. Because the messages should be partitioned into several groups to send to the network, some methods are used to find conflicts between the messages.

The proposed work is about to resolve the problem of cross talk over the network. As we know most of the switched network are designed with some shared switched to reduce the number of resources over the network. Because of this some problems occur over the network. One of such problem is the data loss or the data interruption because of the crosstalk over the network. As in proposed work we provide the solution of data distortion because of crosstalk.

3. DIFFERENT APPROACHES FOR CROSSTALK DETECTION

3.1 Window Method

It is one of the simplest method. Window method is the method that is used to find the messages that are not in the same group because it causes crosstalk in the network. If we consider the network of size N*N, there are N source and N destination address. Combination matrix is formed by combining source and its destination address. From this, optical window size is M-1, where M=log2N and N is size of network. In window method, number of windows is equal to number of stages [5].

0	0	0	1	0	1
0	0	1	0	0	1
0	1	0	0	1	1
0	1	1	1	1	0
1	0	0	0	0	0
1	0	1	0	1	0
1	1	0	1	0	0
1	1	1	1	1	1

Fig. 2 Conflict Matrix By Window Tech.

3.2 Improved Window Method

In this method the first window is eliminated for this we make the conflict matrix initialized to 0, here number of windows is M-1. It takes less time to find conflicts than the windows method. Therefore, it is called improved window method

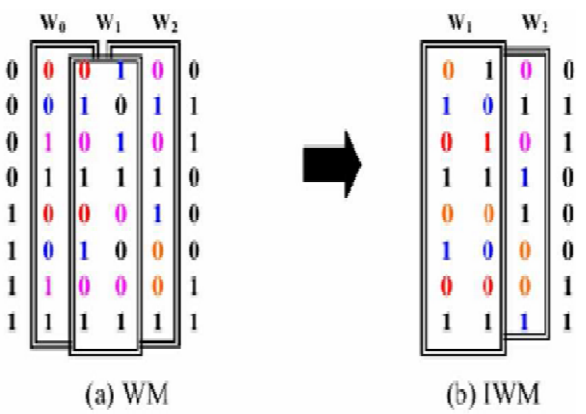

Fig. 3. Improved Window Method

3.3 Bitwise Window Method

In this method, source and destination address is in decimal format. Number of windows is $\log_2 N$. It is shown in figure. Thus, from combination matrix, the optical window size is only one for a different network size and the number of window is $\log_2 N$ [10]. In other words, there are only one decimal number in each row and each window is taken for comparison and finding a conflict.

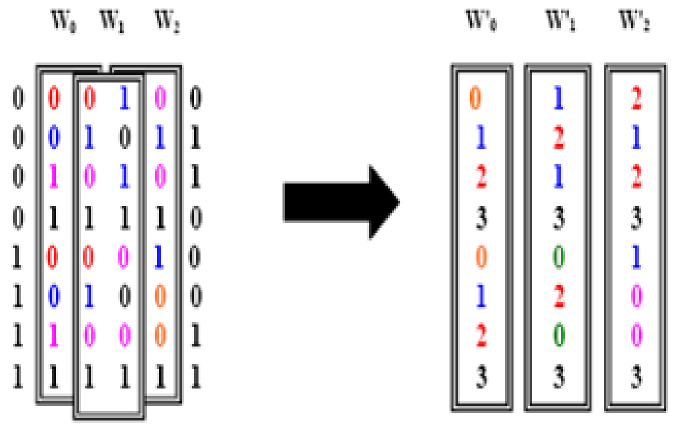

Fig. 4 Bitwise Window Method

4. TIME DOMAIN APPROACH FOR AVOIDING CROSSTALK IN OPTICAL NETWORKS

Another way to solve the problem of crosstalk is the time domain approach. With the time domain approach, the same objective is achieved by treating crosstalk as a conflict; that is, two connections will be established at different times if they use the same SE whereas we want to distribute the messages to be sent to the network into several groups, a method is used to find out which messages should not be in the same group because they will cause crosstalk in the network. A set of connections is partitioned into several subsets such that the connections in each subset can be established simultaneously in a network as shown in figure. There Is no crosstalk in these subsections. This approach makes importance in optical MINs for various reasons:

4.1 Optical Interconnection Networks

Advances in electro-optic technologies have made optical communication a good networking choice for the increasing demands of high channel bandwidth and low communication latency of high performance computing /communication applications. Fiber optic communications offer a combination of high bandwidth, low error probability, and gigabit transmission capacity. Multistage Interconnection Networks (MINs) are very popular in switching and communication applications and have been used in telecommunication and parallel computing systems. But these days with growing demand for bandwidth, optical technology is used to implement interconnection networks and switches. In electronic MINs electricity is used, where as in OMINs light is used to transmit the messages.

4.2 Multistage Interconnection Networks

MINs consist of more than one stages of small interconnection elements called switching elements and links interconnecting them. MINs are used in multiprocessing systems to provide cost-effective, high-bandwidth communication between processors and/or memory modules. A MIN normally connects N inputs to N outputs and is referred as an NxN MIN. The parameter N is called the size of the network.

4.3 Optical Multistage Interconnection Networks

An OMIN can be implemented with either free-space optics or guided wave technology. It uses the Time Division Multiplexing. To exploit the huge optical bandwidth of fiber, the Wavelength Division Multiplexing (WDM) technique can also be used. With WDM the optical spectrum is divided into many different logical channels, and each channel corresponds to a unique wavelength. Optical switching involves the switching of optical signals, rather than electronic signals as in conventional electronic systems. Two types of guided wave optical switching systems can be used. The first is a hybrid approach in which optical signals are switched, but the switches are electronically controlled. With this approach, the use of electronic control signals means that the routing will be carried out electronically. As such the speed of the electronic switch control signals can be much less than the bit rate of the optical signals being switched. So, with this approach there is a big speed mismatch occurs due to the high speed of optical signals. The second approach is all-optical switching.

4.4 Omega Networks

The first type of multistage interconnection network we will examine is the Omega Network. A key feature of this network is that there is only one unique path from each input to each output.[2] In other words, every input can find a path to any output. In order to determine the connection paths between switches, the perfect shuffle algorithm is used. This algorithm is repeated at every stage of the network. It can be observed that the first and last inputs are directly connected to the destination elements. An Omega Network is said to be of size N as it is comprised of $\log_2 N$ stages of 2x2 switches. Each stage is made from N/2 of these switches. The number of switches required in the network can also be determined by using the following equation where S represents the total number of switches: $S = (N/2) * \log_2 N$. It should also be noted that this type of interconnection network is blocking.[1] This characteristic implies that when a connection between a pair of switches is being utilized, new requests for connections may not be possible as some resources are busy. To better understand Omega Networks, we will consider an example. It will demonstrate the process of connecting the different switch elements and find the routing from the input to the destination.

5. SIMULATION & RESULTS

In this proposed we presented the work in a self constructed simulation environment. We have taken the input dynamically from the user perform a different method analysis to check the confliction and finally performed the simulation graphically. To work with the simulation environment we have presented a network scenario with the following parameters.

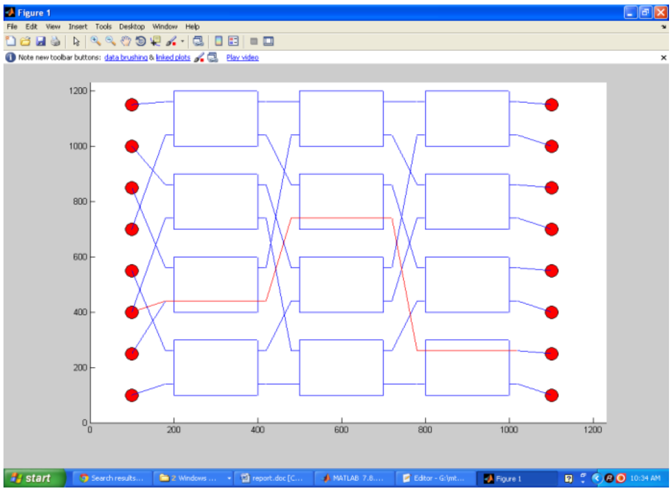

Fig. 5 Optical Multistage Interconnection Networks

To demonstrate the interconnections of the Omega network, consider a network with 8 inputs and 8 outputs built using 2x2 switches. We wish to connect input 011 to output 010. Using the equations outlined above, the number of stages is calculated to be $\log_2 8 = 3$ and each stage has $8/2 = 4$ switches. The total number of switches is the product of these two values, $3*4 = 12$. The next step is to connect the inputs to the first set of switches. To do this, we use the perfect shuffle algorithm which performs a shift-left on the input bits. Therefore, 011 (3) would be connected to the switch representing 010 (2). This process is repeated for each input and replicated at each stage. Lastly, we use the bits of the destination address to determine the path of the connection. A 0 represents the upper output of a switch and a 1 represents the lower output. Starting from the MSB, the output 010 would have the following routing: upper, lower, upper. The final Omega Network layout and routing (in red) is shown in the figure below.

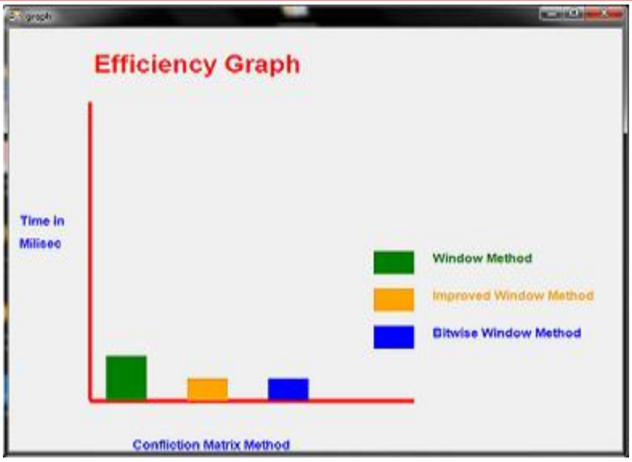

Fig. 6 Efficiency Graph

6. CONCLUSION & FUTURE WORK

As we have observed from the proposed system is providing the solution to avoid the confliction over the cross talk in a multistage switch network. In such work we are providing the prevention mechanism to avoid the confliction. It means the system will observe the current input over the network and check for the possibility of the confliction. If the confliction is observed a delay will be defined in such way the communication are place without any confliction. The system is beneficial to provide a reliable data communication in a multistage network. Here the work is presented on the omega networks.

We have presented the work on an omega network to detect the confliction in multiple data communication. The proposed work can be enhanced in different ways

- We can implement the approach on some other multistage networks. Each switched network having the problem of cross talk we can implement the same logic with different concept according to the network.
- We can also implement the network according to more number of nodes as well according to more number of multiple stages.
- We presented the work on the basis of prevention of collision over the network. We can enhance this work by detecting the collision and then performing a dynamic re routing to perform the reliable data transmission.

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