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An Algorithm, Eliminating the Conflicts by Diagonal Scanning of the Connection Matrix*

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Introduction

The present paper suggests one of the possible solutions of the problem with the conflicts in commutation nodes of distributed information networks.

Fig.1 shows a part of a distributed information system with four commutation nodes **A**, **B** ,**C** and **D**. Every commutation node consists of a Crossbar Switch and a processor, controlling the operation of a commutation network node (a node processor).

The algorithm eliminating the conflicts is designed for a processor, controlling the operation of a commutation network node (Node Processor).

The formulation of the problem with the conflicts, accompanying the functioning of the commutation nodes, is as follows: The switches in the commutation nodes are with $N \times N$, where N is the number of sources of packet messages, being connected through the switch of the commutation node to N receivers of these messages. The traffic through the commutation node has random character and depends on the users. The conflicts occur in two cases:

When a messages source requests connection to two or more receivers of messages.

When a receiver of the messages has a request for connection to two or more messages sources.

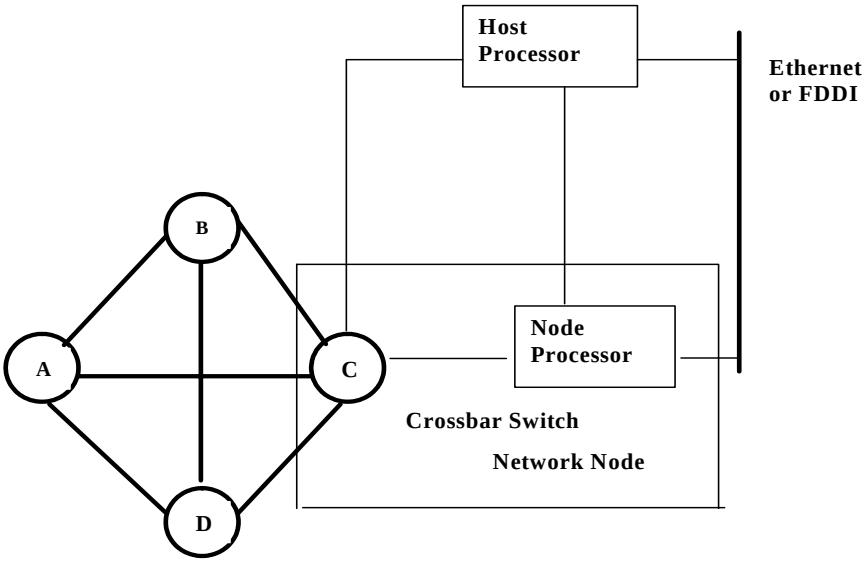

Fig. 1. High performance parallel interface synchronous optical network

The avoiding of the conflicts has direct relation with the commutation node performance.

Description of the problem with conflicts

The status of a commutation node switch is represented by the so called connection matrix. For a switch with dimensions $N \times N$ the matrix of connections T is also of dimension $N \times N$, every term being $T_{ij} = 1$, if there is a request for connection between the message source i and the receiver j. Otherwise $T_{ij} = 0$.

The conflict situation appears, when in any row of the matrix of connections the number of the units is greater than one, which corresponds to the case, when one source requests connection to more that one receiver. The presence of more than one unit in any of the columns of matrix T is also an indication that more than one source has requested a connection to the same receiver [1].

An algorithm eliminating the conflicts

The approach for eliminating the conflicts consists in scanning the matrix of connections by rows until a unit is found, after that diagonal search for units in the connection matrix is accomplished (Figs. 2 and 3).

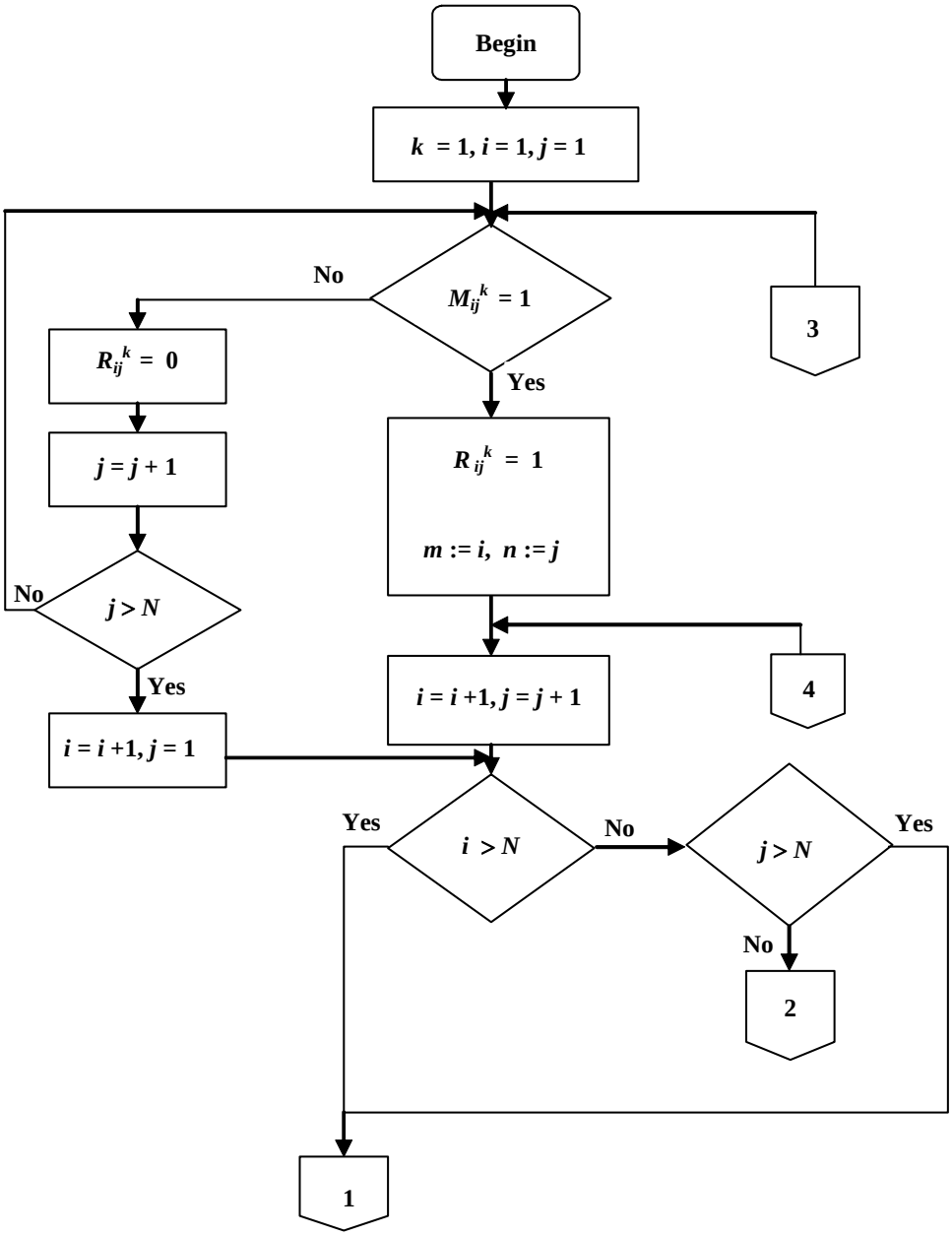
Begin
k = 1, i = 1, j = 1
No
$M_{ij}^{k} = 1$
3
$R_{ij}^{k} = 0$
Yes
j = j + 1
$R_{ij}^{k} = 1$
m := i, n := j
No
j > N
Yes
i = i +1, j = 1
i = i +1, j = j + 1
4
Yes
i > N
No
j > N
Yes
No
2
1

Fig. 2

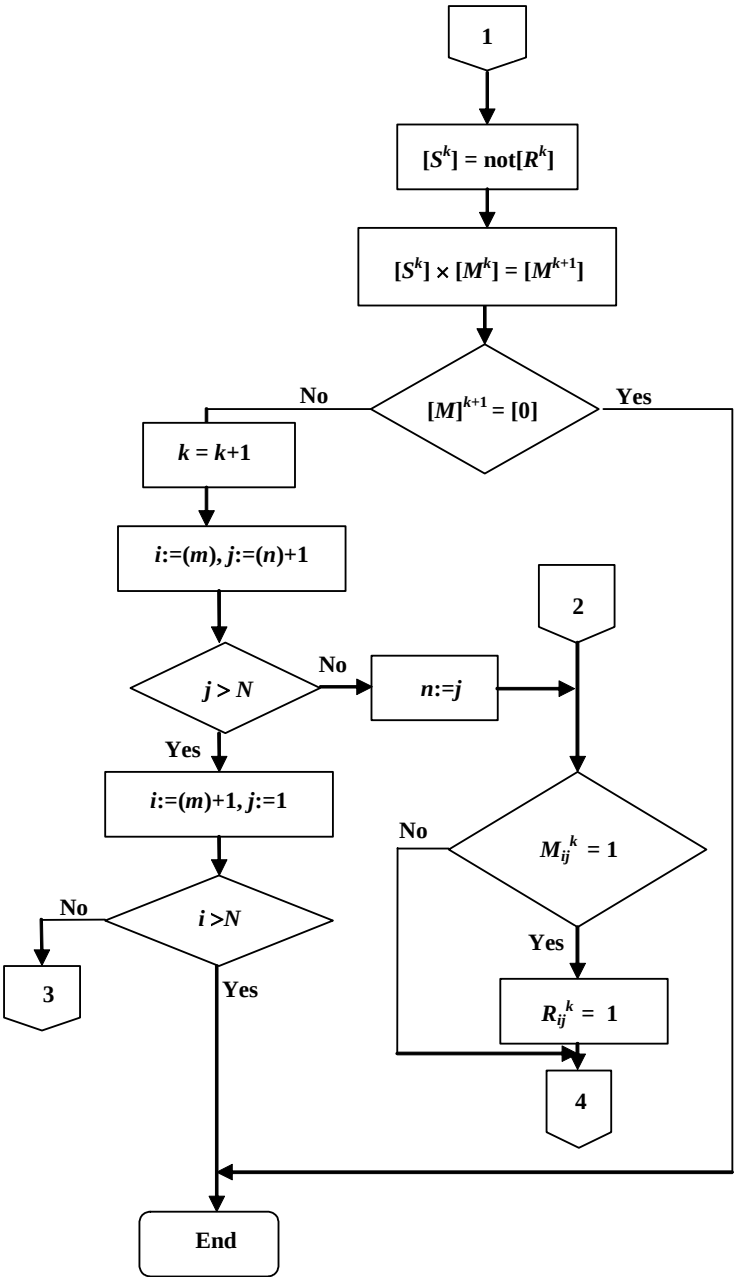

Fig. 3

The diagonal search is selected, because the diagonal order of units (the service requests) is non-conflict [2].

When a diagonal is discovered, an enabled matrix of the connections R^k, is formed, which can be immediately realized.

The scanning of connections matrix is realized from left to right and up down. Finding a unit is connected with storing the coordinates and the current values of

the indices *i* and *j*) in two working cells *m* and *n*. This is done in order to start next scanning from the place, where the last has finished. The diagonal search is realized, increasing by one the coordinates (*i* and *j*).

Before accomplishing the next scanning by the connections matrix, already realized connections must be eliminated. For this purpose a matrix – $[S^k]$ is formed.

$[S^k]$ = not$[R^k]$ is multiplied term by term with the reduced connections matrix M^k

$[S^k] \times [M^k] = [M^{k+1}]$. At $k = 1$, $M^1 = T$, i.e. the output matrix of connections.

Conclusion

The advantage of the algorithm is the use of the knowledge that the diagonal located units (service requests) in the connections matrix are apriori non-conflict. This circumstance speeds up the service process, at each stage eliminating the requests realized by the so called matrices-connections.

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Алгоритм элиминирования конфликтов при помощи диагонального сканирования матрицы связи

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(Р е з ю м е)

В работе предлагается едно из возможных решений задачи конфликтов в коммуникационных узлах распределенных информационных сетей. Алгоритм состоит в сканировании рядов матрицы связи до того, как найдется единица. Потом осуществляется диагональный поиск единиц. При этом допускается, что диагонально позиционированные единицы (заявки обслуживания) в матрице связи априори безконфликтными.